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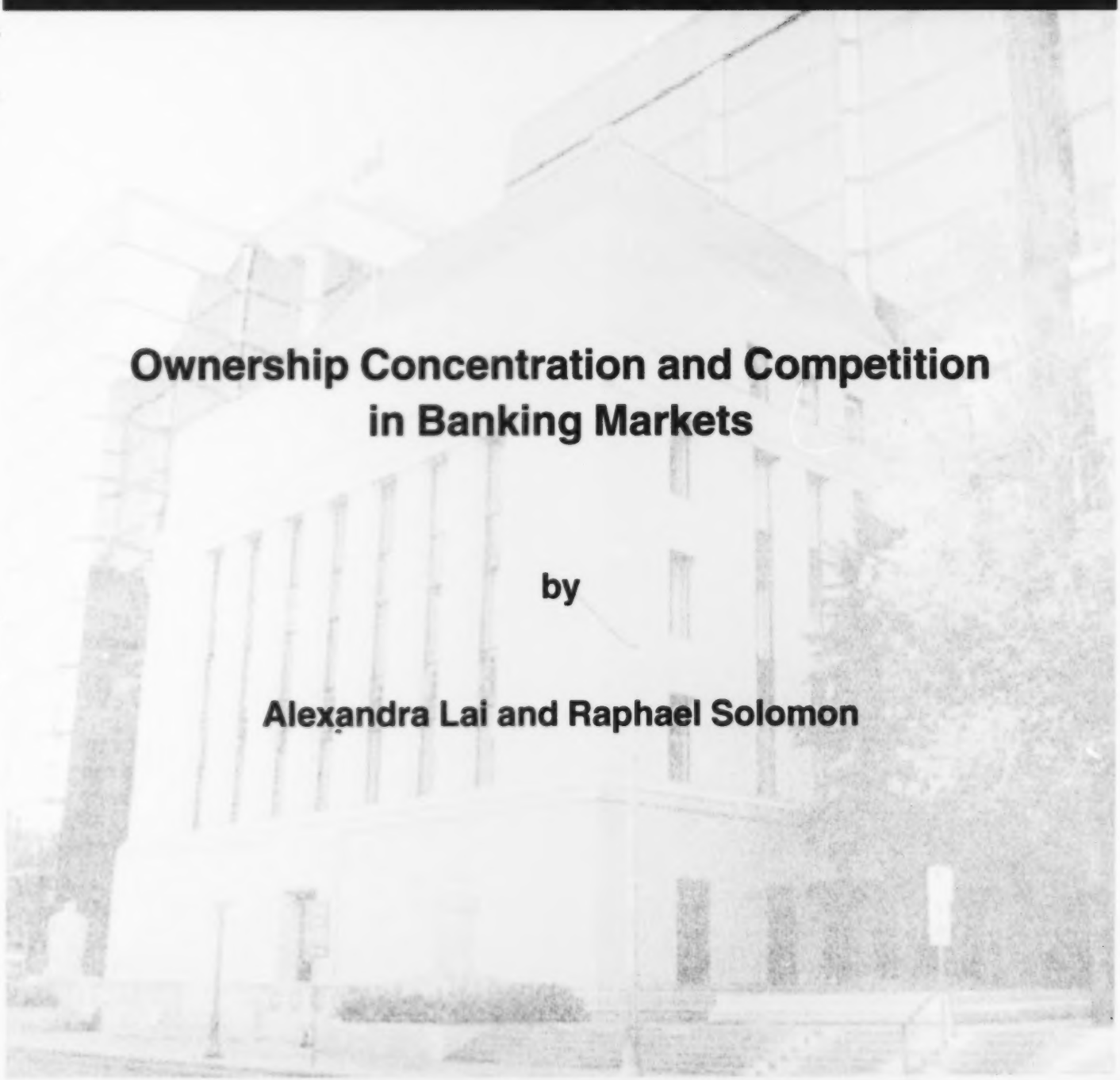

Ownership Concentration and Competition in Banking Markets

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The views expressed in this paper are those of the authors.
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Abstract

Many countries prohibit large shareholdings in their domestic banks. The authors examine whether such a restriction restrains competition in a duopolistic loan market. Blockholders may influence managers' output decisions by choosing capital structure, as in Brander and Lewis (1986). For the blockholder, debt has an additional benefit: it "disciplines" a manager by reducing the amount of free cash flow from which the manager can divert funds. A larger blockholder can exert more control. The authors show that an economy with blockholders often leads to a more competitive banking sector. Hence, a restriction on the size of blockholdings has anti-competitive results.

JEL classification: G21, G28, G32, L10
Bank classification: Financial institutions; Financial services; Financial system regulation and policies

Résumé

De nombreux pays interdisent la détention de larges participations dans le capital des banques nationales. Les auteurs cherchent à déterminer si une telle limitation restreint la concurrence sur un marché duopolistique du crédit. S'inspirant de Brander et Lewis (1986), ils postulent que les gros actionnaires peuvent influencer les décisions de gestion relatives au niveau des prêts en choisissant la structure du capital. Aux yeux de ces actionnaires, la dette offre un avantage supplémentaire : elle « discipline » les gestionnaires du fait qu'elle réduit le montant des ressources d'autofinancement disponibles qu'ils peuvent détourner à leur profit. Un gros actionnaire est en mesure d'exercer davantage de contrôle. Les auteurs montrent que la présence de gros actionnaires au sein d'une économie accroît souvent la compétitivité du secteur bancaire. Limiter la taille des participations a donc des effets négatifs sur la concurrence.

Classification JEL : G21, G28, G32, L10
Classification de la Banque : Institutions financières; Services financiers; Réglementation et politiques relatives au système financier

1. Introduction

Are restrictions on the ownership structure of banks anti-competitive? The question is relevant to more than 50 countries,[1] which either prohibit individuals and corporations from holding more than a given fraction of a bank's shares or require that large shareholdings be reviewed by the government or the central bank. Figure 1 shows a histogram of the various shareholding restrictions.[2] Our paper examines whether this type of restriction restrains competition in a duopolistic model of the loan market.

Rules requiring dispersed shareholdings can cause several problems. They may deter foreign entry. They may also act as a poison pill, a mechanism to prevent hostile takeovers, without which banks might have access to cheaper capital.[3] Finally, they may increase agency costs. This paper focuses on the latter problem.

In an environment without shareholding restrictions, large shareholders may obtain control of banks to discipline management and to minimize agency costs. In so doing, they make the banking system more competitive (lower prices, higher output) and thus more efficient. In our model, large shareholders achieve this goal by issuing bank debt (taking uninsured deposits).

In our game-theoretic model of two competing banks, managers make daily operating decisions (represented by the choice of loan output), but also divert a fraction of the bank's residual cash flow. Either the manager or the controlling blockholder may choose the bank's capital structure. To obtain control, the blockholder must engage in costly monitoring. Monitoring does not guarantee control; rather, it yields the blockholder control with probability (less than one) increasing in the number of shares held. The timing of the game is as follows: (i) potential blockholders simultaneously decide whether to acquire a controlling share of a bank and monitor management, (ii) the manager or the controlling blockholder chooses the capital structure of the bank, and (iii) managers compete in the market for bank loans.

From a blockholder's perspective, debt has two consequences. First, it "disciplines" a manager by reducing the amount of free cash flow from which the manager can divert funds. Second, it has a strategic effect vis-à-vis the other bank. Specifically, holding fixed the amount of debt at the rival bank, a unilateral increase in one bank's debt increases its own output while reducing that of the other bank.[4] This raises the more indebted bank's market share and profits at the expense of the other bank, since industry profits decline.

In a symmetric Nash equilibrium, where both banks issue debt, each bank incurs lower profits from making loans than they would under coordinated actions. In our model, however, an increase in debt at both banks may increase bank value, even as profits fall, because debt transfers payoffs from the manager to the shareholders. Moreover, industry output is higher. We show that, since managers issue less debt than blockholders, the presence of controlling blockholders increases both firm value and competition in the loans market. Hence, if shareholding restrictions prevent

[1] The appendix provides a full list of countries with this type of banking regulation as of 2003, created from the database of the World Bank Survey of Bank Regulation and Supervision. See Barth, Caprio, and Levine (2001) for more details.

[2] Although most OECD countries, apart from Australia, Canada, Luxembourg, and Norway, do not have formal restrictions on bank shareholding, some countries (including the United States, the United Kingdom, and Japan) exhibit widely held shareholding patterns for their largest publicly traded banks. This may suggest that norms in these countries constrain bank ownership concentration.

[3] See Gouvin (2001), Malatesta and Walkling (1988), and Ryngaert (1988).

[4] Brander and Lewis (1986) demonstrate that an increase in debt causes profit-maximizing managers to compete more aggressively in the output market relative to the pure (debt-free) Cournot outcome.

blockholders from existing, both firm value and competition in the loans market decrease. In the vast majority of our numerical examples, a rule restricting ownership concentration to no more than 20 per cent creates two possibilities.[5] In the first, blockholdings never exist; in the second, blockholders exist but do not monitor and never gain control.

Our model is related to three distinct strands of literature. One strand relates capital structure to output. The key paper is by Brander and Lewis (1986), on which we draw extensively. Maksimovic (1988) models a repeated game in an oligopoly setting, in which collusive outcomes can occur. Debt holding can destroy the sustainability of collusion, leading to more competitive outcomes. Bolton and Scharfstein (1990) also relate debt financing to the aggressiveness of competition in a theory of predation. Dasgupta and Titman (1998) link pricing (and hence market share) decisions to capital structure through the effect of capital structure on the rate by which a firm discounts future profits. Campello (2003) finds capital structure empirically significant for explaining product market outcomes.

A second strand of literature models ownership structure and/or capital structure as responses to agency problems. Within this strand, only Zhang (1998) links capital structure and ownership structure in a model with managerial risk aversion and inside ownership. Agency problems between management and shareholders can also take the form of empire building and diversion of perquisites.[6] Jensen (1986) notes that debt is a good antidote to managerial empire building and diversion of perquisites. In these models where capital structure is seen as alleviating agency problems, it also has an impact on firm value.

A third strand relates ownership structure to firm value. Our results are consistent with the main message of this literature: a large blockholder increases firm value. Burkart and Panunzi's (2001) model has a manager, a large shareholder, and some dispersed shareholders, where shareholders need to monitor to prevent managerial diversion of resources. Despite the conflict of interest between dispersed shareholders and the blockholder, for the blockholder to win effective control of the firm is always value-enhancing, because this aligns the interests of shareholders and the manager. Burkart, Gromb, and Panunzi (1997) and Bolton and Von Thadden (1998) consider the optimal ownership concentration as a response to agency problems between management and shareholders. Barclay and Holderness (1990) show empirically that the value of the firm increases if there is a blockholder, but that the increase is limited if the blockholder does not exercise control. In particular, actions that Barclay and Holderness (1990) interpret as monitoring, such as changing the composition of the board or replacing the management, yield the highest benefits in terms of firm value. Caprio, Laeven, and Levine (2004) provide empirical evidence of a positive relationship between ownership concentration and value for a sample of 244 publicly traded banks across 44 countries.[7]

Our model links ownership structure to output through the choice of an optimal capital structure under agency problems, uniting these three strands of literature. A related paper examines the link between ownership structure and the incentive to acquire other firms: Allen and Cebenoyan (1991) allow for interaction between concentrated insider ownership and concentrated outsider ownership (the blockholder). In their sample of 58 American bank holding companies, they find

[5] As Figure 1 shows, 20 per cent is both the median and modal restriction in the sample of countries that have formal bank shareholding restrictions.

[6] See Jensen and Meckling (1976) on agency problems.

[7] A related literature examines the effects of insider ownership, as opposed to the outsider ownership that we consider. See Stulz (1990) for a theoretical model and DeYoung, Spong, and Sullivan (2001), Morck, Shleifer, and Vishny (1988), and McConnell and Servaes (1990) for empirical evidence.

that banks with a blockholder and no large inside shareholdings tend to be less acquisitive. To the extent that more competition results from fewer acquisitions, the blockholder without the inside shareholder may be said to be the most competitive ownership structure.

We abstract from private benefits of control and focus exclusively on the existence of shared benefits of control. Barclay and Holderness (1992) and others find evidence of both shared and private benefits of control, and these generally depend on the size of the blockholding.[8] Holderness and Sheehan (1998), however, report evidence from the United States that large blockholders are constrained from expropriating cash flows and from other actions inimical to the interests of minority shareholders.[9] Pedersen and Thomsen (2003) also find that the type of blockholder – institutional investor, corporation, financial firm, or private individual – matters for control. They find that financial firms are most likely to assert control. In our model, we can interpret the idea of different propensities to assert control in terms of different (opportunity) costs of monitoring.

This paper is organized as follows. Section 2 develops the model and summarizes the multi-stage game with a timeline of the model (Figure 2). In section 3, we solve for the subgame-perfect Nash equilibrium in all stages of the game. We draw out the policy implications of our analysis in section 4. In section 5, we provide some simple empirical facts broadly consistent with our model. Section 6 offers some conclusions.

2. The Model

There are two banks in the economy, indexed by $i = 1, 2$.[10] Each bank i is run by a manager who holds no equity. Each bank has a potential blockholder who purchases a fraction, $\alpha_i \geq 0$, of the bank's shares. Atomistic shareholders own the remaining shares. If the potential blockholder declines to purchase shares ($\alpha_i = 0$), all shares are bought by dispersed owners. All economic agents are risk-neutral and maximize wealth.

Managers choose output levels (of loans supplied) in a non-co-operative (Cournot) game. The manager also controls the choice of debt level if there is no blockholder. A blockholder, however, can influence the capital structure choice by monitoring, at cost c. A controlling blockholder chooses the level of debt issued by the bank. We assume that the proceeds of the risky debt issue are immediately distributed to shareholders as dividends.

We assume that there are no conflicts of interest between the blockholder and dispersed shareholders, and we therefore focus on conflicts of interest between owners and managers. Managers are paid a fixed salary and also divert an exogenous fraction, ϕ, of banks' cash flow net of payments to debt holders (hereafter, the residual cash flow) for their own consumption.[11] Since the proceeds of the debt issue are distributed to shareholders, debt reduces the residual cash flow from which the manager diverts. A blockholder can thus "discipline" the manager through the choice of capital structure. The bank's debt level also affects the manager's output decisions.

[8] See also Barclay and Holderness (1989) and Mikkelson and Regassa (1991).

[9] In particular, by citing the case of Turner Broadcasting (p. 8), the authors demonstrate that ownership does not always entail control, even when the blockholder owns a majority of the shares.

[10] The results generalize to the case of a small number of banks.

[11] In reality, managers are usually paid a base salary along with bonuses, stock, or stock options, which are often regarded as performance-related pay. In this paper, we do not consider the issue of optimal compensation and hence abstract from other components of executive pay. While it is possible to think of an optimal contract that alleviates the agency problem we have posed, a more recent view is that the design of executive pay is itself subject to managerial influence and is part of the agency problem (Bebchuk and Fried 2003; and Bebchuk, Fried, and Walker 2002). We consider some related issues in section 5.

We model the output decisions of managers, capital structure decisions, and the shareholding and monitoring decisions of potential blockholders in a one-shot multi-stage game. The various stages of the model are described below.

Stage 1: Blockholding and monitoring decisions

At this stage, a potential blockholder acquires a share, $\alpha_i \in [0, \alpha^{max}]$, of the bank and simultaneously decides whether to monitor. We represent legal restrictions on ownership concentration by $\alpha^{max} < 1$. The decision to monitor depends on how likely monitoring leads to effective control and the benefits of control.[12] Blockholders face uncertainty over whether their monitoring is successful. If the blockholder monitors, the blockholder wins control from the manager with a probability $p(\alpha_i)$, a non-decreasing function of the size of blockholding, α_i.[13] A controlling blockholder determines the capital structure of the bank by choosing the face value, D_i, of debt to issue. With probability $1 - p(\alpha_i)$, the manager retains control and chooses the debt level.

Stage 2: Capital structure decision

At this stage, the controlling blockholder of bank i chooses the debt level, D_i, to maximize the expected value of the firm, which can be decomposed into the value of the firm at stage 3 and the value of debt:

$$V^i(D_i, D_j) = V^{iE}(D_i, D_j) + V^{iD}(D_i, D_j).$$

Bank i's equity and debt values depend not only on its own debt level but also on the level of debt issued by its competitor bank, D_j. The manager who retains control chooses debt to maximize the expected residual cash flow, which is equivalent to maximizing the value of the firm at stage 3. We interpret debt, D, as uninsured (wholesale) deposits. We also abstract from competition for deposits and the sequential-service nature of bank deposits. Whereas banks typically issue debt both to cover operational funding requirements and for strategic reasons, bank debt is purely strategic in this model. Banks issue debt to obtain an advantage in the loans market and to discipline their management.

There are four different control structures:

BB: Blockholders determine debt levels in both banks, $\mathbf{D} = (D^{BB}, D^{BB})$. This occurs with probability $p(\alpha_i)p(\alpha_j)$.

MM: Managers determine debt levels in both banks, $\mathbf{D} = (D^{MM}, D^{MM})$. This occurs with probability $[1 - p(\alpha_i)][1 - p(\alpha_j)]$.

BM: Bank i's blockholder and bank j's manager choose debt levels, $\mathbf{D} = (D^{BM}, D^{MB})$. This occurs with probability $p(\alpha_i)[1 - p(\alpha_j)]$.

MB: Bank i's manager and bank j's blockholder choose debt levels, $\mathbf{D} = (D^{MB}, D^{BM})$. This occurs with probability $[1 - p(\alpha_i)]p(\alpha_j)$.

[12] The benefits of control are endogenously determined in our model. Following Burkart and Panunzi (2001), we differentiate the rights of control from effective control. That is, blockholders have rights of control conferred by ownership, but may or may not choose to exercise control. Upon choosing to exercise control, there is some uncertainty whether they obtain effective control. This makes sense when $\alpha^{max} < 0.5$, so that blockholders need to obtain the right to vote the proxies of dispersed shareholders. How easily they can do this depends on the size of their shareholdings, their monitoring effort, voting rules, and (potentially) luck.

[13] We assume that p is non-decreasing in α but need not be differentiable; we require $p(0) = 0$ for $p(\alpha)$ to be reasonable.

We denote the debt choice by a controlling blockholder facing a blockholder in the other bank as D^{BB}, and one facing a manager as D^{BM}. Likewise, the debt choice by a manager facing another manager is denoted as D^{MM}, while that of a manager facing a controlling blockholder in its competitor bank is D^{MB}. The likelihood of any of these four control structures depends jointly on α_i and α_j.

Stage 3: Output decision

The managers play a Cournot game, taking D_i and D_j as given. We denote bank i's profit, net of the manager's salary and payments to insured retail depositors, as $R^i(q_i, q_j, z_i)$, where (q_i, q_j) is a vector of loan quantities and z_i, an independent and identically distributed state variable, is uniformly distributed over the unit interval. We let R^i_i denote the derivative of R^i with respect to q_i, R^i_j the derivative of R^i with respect to q_j, and R^i_z the derivative of R^i with respect to z_i. Following Brander and Lewis (1986), we impose the following restrictions on R^i: $R^i_{ii} < 0$ (concavity), $R^i_j < 0$, $R^i_{ij} < 0$ (loans are substitutes as well as strategic substitutes, which means that a bank's incentive to increase loans increases when the other bank reduces its loans), $R^i_z > 0$, and $R^i_{iz} > 0$ (so that a higher realization of z_i is beneficial for bank i).

The manager of bank i chooses loan levels, q_i, to maximize expected residual cash flow, which is equivalent to maximizing the value of equity at this stage. Let $\hat{z}_i$ be the critical value of z_i for which the bank is in default if and only if $z_i < \hat{z}_i$, implicitly defined by $R^i(\mathbf{q}, \hat{z}_i) - D_i = 0$. Then, bank i's expected residual cash flow (net of debt repayment) is $\int_{\hat{z}_i}^1 \left[R^i(q_i, q_j, z_i) - D_i\right] dz_i$, the value of equity is $V^{iE} = (1-\phi) \int_{\hat{z}_i}^1 \left[R^i(q_i, q_j, z_i) - D_i\right] dz_i$, and the value of debt is $V^{iD} = \int_0^{\hat{z}_i} R^i(q_i, q_j, z_i) dz_i + (1 - \hat{z}_i) D_i$. It is noteworthy that $\hat{z}_i$ is a function of q_i, qj, and D_i. Brander and Lewis (1986) show that $\hat{z}_i$ is increasing in D_i and q_i, and decreasing in q_j, $j \neq i$.

Stage 4: Payoffs

Uncertainty is resolved (z_i and z_j are realized), profits are realized, and debt is repaid, if possible. If no default has taken place, the manager diverts a fraction, ϕ, of the bank's residual cash flow, and shareholders obtain their share of the firm's public value, $(1-\phi)\max\{R^i - D_i, 0\}$. If default occurs, debt holders get all of the bank's profits, while the manager and shareholders get nothing (limited liability).

The value of debt at time of issue (stage 2) is V^{iD}, as defined above, and it accrues to shareholders. Hence, shareholders internalize the value of debt when choosing the optimal debt level in stage 2. Bank value and the price of bank shares at stage 1 is then $E[V^{iE} + V^{iD}]$.

3. Equilibrium

In this section, we solve the model for subgame-perfect Nash equilibria in pure strategies. That is, we start with the last stage of the game (stage 3) to solve for equilibrium Cournot outputs, given debt levels. We then proceed to solve for equilibrium debt levels (stage 2) under the four possible control structures. Finally, we solve the game between potential blockholders, who simultaneously choose the size of shareholding to acquire and decide whether to monitor. Our analytical results are supplemented by results from numerical simulations.[14]

[14]While we use many parameterizations to determine the sensitivity of our results, we do not attempt to parameterize our model with actual data. Therefore, we note where a result is the outcome of those simulations. The

3.1 Equilibrium Cournot output

The manager at bank i faces the following maximization problem:

$$\max_{q_i \geq 0} \int_{\hat{z}_i}^{1} [R^i(q_i, q_j, z_i) - D_i] dz_i. \tag{1}$$

Assuming an interior solution, the first-order condition is

$$\int_{\hat{z}_i}^{1} R_i^i(q_i, q_j, z_i) - D_i] dz_i = 0. \tag{2}$$

We restate here propositions 1 and 2 of Brander and Lewis (1986).

Proposition 1 *(i) For identical banks, equilibrium quantities are higher the higher are debt levels. That is, $dq^*/dD^* > 0$. (ii) For non-identical banks, $D_i \neq D_j$, a unilateral increase in bank i's debt increases bank i's equilibrium quantity and reduces bank j's equilibrium quantity. That is, $dq_i^*/dD_i^* > 0$ and $dq_j^*/dD_i^* < 0$.*

3.2 Equilibrium debt levels

Whenever a manager is in control at bank i (control structures MM and MB), the debt level is chosen to maximize the expected residual cash flow. The manager's problem is as follows:

$$\max_{D_i \geq 0} \int_{\hat{z}_i}^{1} [R^i(q_i^*, q_j^*, z_i) - D_i] dz_i. \tag{3}$$

Taking the derivative with respect to D_i yields

$$-[1 - F(\hat{z}_i)] + \int_{\hat{z}_i}^{1} R_j^i(q_i^*, q_j^*, z_i) dz_i \frac{dq_j^*}{dD_i}. \tag{4}$$

The first term is negative and reflects the decline in residual cash flow for every dollar of debt that is repaid. The second term is positive, because both R_j^i and dq_j^*/dD_i are negative. This represents the *strategic effect* of debt. A higher level of debt at bank i induces a decrease in the equilibrium quantity of loans at bank j. This increases bank i's profits. The optimal debt level reflects these conflicting effects. A manager will choose a positive debt level only if the strategic effect of debt is sufficiently strong.

Whenever a blockholder is in control at bank i (control structures BB and BM), debt level is chosen to maximize the value of the firm, allowing for the diversion that will happen after cash flows are realized. The blockholder's problem is given in (5), or, equivalently, in (6):

$$\max_{D_i \geq 0} (1 - \phi) \int_{\hat{z}_i}^{1} [R^i(q_i^*, q_j^*, z_i) - D_i] dz_i \tag{5}$$

$$+ \int_{0}^{\hat{z}_i} R^i(q_i^*, q_j^*, z_i) dz_i + D_i[1 - F(\hat{z}_i)],$$

appendix details our numerical solution procedure.

$$\max_{D_i \geq 0} \int_0^1 R^i(q_i^*, q_j^*, z_i) dz_i - \phi \int_{\hat{z}_i}^1 [R^i(q_i^*, q_j^*, z_i) - D_i] dz_i. \tag{6}$$

Taking the derivative with respect to D_i while substituting the manager's first-order condition yields

$$\begin{aligned} &\int_0^{\hat{z}_i} R_i^i(q_i^*, q_j^*, z_i) dz_i \frac{dq_i^*}{dD_i} + \int_0^1 R_j^i(q_i^*, q_j^*, z_i) dz_i \frac{dq_j^*}{dD_i} \\ &-\phi \left\{ \int_{\hat{z}_i}^1 R_j^i(q_i^*, q_j^*, z_i) dz_i \frac{dq_j^*}{dD_i} - [1 - F(\hat{z}_i)] \right\}. \end{aligned} \tag{7}$$

Since $R_{iz}^i > 0$, the first-order condition from the output stage, equation (2), implies that $R_i^i < 0$ for $z_i \in [0, \hat{z}_i]$. Hence, the first term of (7) is negative, because a higher level of debt, and the resulting higher output, reduces profits for low realizations of z_i. The second term is positive, representing the strategic effect of debt. This strategic effect is larger for shareholders than for the manager, since it increases both the value of equity and the value of debt. In our model, shareholders internalize the value of debt, whereas managers disregard it. The expression inside the bracket in the final term of (7) is simply the derivative of the manager's objective function. We conjecture that, evaluated at the optimal debt level for the blockholder's problem, this final term is positive. This term represents the marginal reduction in the amount the manager can divert from cash flow, the *disciplining effect* of debt.[15] That is, while the manager increases debt up to the point where the marginal contribution of debt to cash flow is zero, a blockholder increases debt beyond that point to discipline the manager.

We assume that both the manager's and the blockholder's problems have unique interior solutions: both the expected residual cash flow as well as the value of the firm are concave in their own debt levels. We also assume that the value of a bank's debt is concave in the level of that debt. To compare optimal debt levels arising from the managers' and the blockholder's problems, we introduce the idea of *debt capacity* in the context of this model. Debt capacity of bank i is some debt level $\overline{D} = \arg\max_{D_i} V^{iD}$. Our assumptions above guarantee that each bank has a unique debt capacity.

Proposition 2 *Given that the bank is not at its debt capacity, blockholders always prefer to issue a higher level of debt than managers would. That is, $D^{BB} > B^{MB}$ and $D^{BM} > D^{MM}$. Furthermore, if debt levels across banks are strategic substitutes, then $D^{MB} \leq D^{MM} \leq D^{BB} \leq D^{BM}$.*

Proof. See the appendix. ■

The fact that blockholders always choose a higher debt level indicates that debt's disciplining effect is present. While we are unable to show analytically that debt levels are strategic subsitutes in our model, our numerical examples indicate that debt levels are indeed strategic subsitutes. We are interested in the effects of ownership regime on competition, or industry output. The next proposition deals with this relationship. Denote a bank's output and debt choice as q^x and D^x, where $x \in \{BB, BM, MB, MM\}$ indicates the control structure. Also, denote industry output as Q^x.

[15] This is true whenever the manager has an incentive to choose a positive debt level. In all our numercial simulations, we obtain interior solutions for the manager's debt choice.

Proposition 3 *Industry output is highest when both banks have controlling blockholders, and lowest when both banks have managers in control of the capital-structure decision. That is, $Q^{MM} < Q^{BM} < Q^{BB}$, where Q^{MM} is industry output when both banks are manager controlled (M-controlled), Q^{BM} is industry output when one bank is blockholder controlled (B-controlled) and one bank is M-controlled, and Q^{BB} is industry output when both banks are B-controlled.*

Proposition 3 follows because Cournot reaction functions have negative slopes greater than -1, a condition that is required for a stable Nash equilibrium.

We also care about how the ownership regime affects the bank's performance, as measured by the bank's value. Since we are unable to obtain analytical results, we defer this discussion until section 4. It is not obvious a priori whether a control structure with higher debt levels results in a higher bank value. This is because a higher debt level, while "disciplining" managers, also leads to more competition in the loans market and the latter reduces profits, all things equal.

3.3 The blockholding and monitoring decision

To obtain the Nash equilibrium for this stage of the game, we first derive the conditions under which a blockholder will monitor. Returns to monitoring, measured in terms of firm value, depend not only on whether the blockholder wins control, but also on whether the other bank has a controlling blockholder. Hence, if the blockholder at bank i decides to monitor, expected payoffs are $p(\alpha_i)p(\alpha_j)V^{BB} + [1-p(\alpha_i)][1-p(\alpha_j)]V^{MM} + p(\alpha_i)[1-p(\alpha_j)]V^{BM} + [1-p(\alpha_i)]p(\alpha_j)V^{MB}$. Otherwise, expected payoffs are $p(\alpha_j)V^{MB} + [1-p(\alpha_j)]V^{MM}$. The difference between the two has to be greater than c to induce monitoring by the blockholder. That is, a blockholder at bank i monitors if and only if

$$\alpha_i p(\alpha_i)\left\{p(\alpha_j)(V^{BB} - V^{MB}) + [1-p(\alpha_j)](V^{BM} - V^{MM})\right\} \geq c. \tag{8}$$

The derivative of the left side of (8) with respect to α_i is positive; thus, the condition for monitoring can be expressed in terms of a critical blockholding size (concentration):

$$\alpha_i \geq \overline{\alpha}(\alpha_j). \tag{9}$$

This critical shareholding size is a function of the ownership concentration at the other bank, α_j.

Lemma 1 *(i) Given that monitoring occurs, $\alpha_i \geq \overline{\alpha}(\alpha_j)$, the value of the bank is increasing in α_i. (ii) If $V^{BB} + V^{MM} - V^{MB} - V^{BM} < 0$, the critical concentration necessary to induce monitoring is increasing in the other bank's concentration: $\overline{\alpha}'(\alpha_j) > 0$. Otherwise, the reverse is true.*

Proof. See the appendix. ■

Whether $V^{BB}+V^{MM}-V^{B}-V^{M}$ is positive or negative maps into whether monitoring decisions are strategic substitutes or complements. Our numerical simulations suggest that this expression is often negative. Lemma 1 implies that, if monitoring takes place, the blockholder prefers the highest possible concentration (up to the point where $p'(\alpha) = 0$), in order to maximize the chances of winning control. This is because firm value increases whenever the blockholder wins control and is able to determine the capital structure of the bank. The first part of Lemma 1 leads us to the following conclusion.

Corollary 1 *A blockholder who monitors acquires a shareholding of size α^{max}.*

Let $\mathcal{V}(\alpha_i, \alpha_j)$ be the value of bank i as a function of both banks' shareholding concentrations. By the above corollary, $\mathcal{V}$ takes four values:
$\mathcal{V}(\alpha^{max}, \alpha^{max})$, $\mathcal{V}(\alpha^{max}, 0)$, $\mathcal{V}(0, \alpha^{max})$, and $\mathcal{V}(0,0)$. The block-acquisition game has the following normal-form representation:

	B	**NB**
B	$\mathcal{V}(\alpha^{max}, \alpha^{max})$, $\mathcal{V}(\alpha^{max}, \alpha^{max})$	$\mathcal{V}(\alpha^{max}, 0)$, $\mathcal{V}(0, \alpha^{max})$
NB	$\mathcal{V}(0, \alpha^{max})$, $\mathcal{V}(\alpha^{max}, 0)$	$\mathcal{V}(0,0)$, $\mathcal{V}(0,0)$

where **B** denotes the action to acquire a blockholding and **NB** denotes the action not to acquire a blockholding.

The Nash equilibrium outcome of this game depends on whether $\overline{\alpha}(\alpha)$ is increasing or decreasing in α, and on how binding are legal restrictions on ownership. The following cases must be considered:

I. Non-restrictive ownership constraints: $\max\{\overline{\alpha}(0), \overline{\alpha}(\alpha^{max})\} \leq \alpha^{max}$.

II. Moderately restrictive ownership constraints:

(a) $\overline{\alpha}(0) \leq \alpha^{max} < \overline{\alpha}(\alpha^{max})$. This case is relevant only if $V^{BB} + V^{MM} - V^{MB} - V^{BM} < 0$.

(b) $\overline{\alpha}(\alpha^{max}) \leq \alpha^{max} < \overline{\alpha}(0)$. This case is relevant only if $V^{BB} + V^{MM} - V^{MB} - V^{BM} > 0$.

III. Highly restrictive ownership constraints: $\alpha^{max} < \min\{\overline{\alpha}(0), \overline{\alpha}(\alpha^{max})\}$.

Proposition 4 *The Nash equilibrium in cases I and II(b) yields the outcome where both banks have blockholders who monitor their managers and produce a higher expected output relative to the other two cases. Case II(a) produces a Nash equilibrium in which blockholders exist at both banks but neither monitors. In case III, the legal constraints on ownership are so binding that both banks are widely held in equilibrium. Industry output is the same in cases II(a) and III. A relaxation of ownership restrictions, by increasing α^{max}, increases industry output only in cases II(b) and I. However, it has no effect on industry output in cases II(a) and III unless the change results in $\alpha^{max} \geq \overline{\alpha}(\alpha^{max})$.*

Proof. See the appendix. ■

4. Numerical Results

For our numerical simulations, bank profits are given by

$$R^i(q_i, q_j, z_i) = z_i(1 - q_i - \gamma q_j)q_i - e^{-z_i}q_i^2, \tag{10}$$

where $z_i(1 - q_i - \gamma q_j)$ is the (linear) inverse demand function for bank i's loans, $C^i(q_i, z_i) = e^{-z_i}q_i^2$ is bank i's (quadratic) cost function, and $\gamma \in (0, 1]$ is a measure of substitutability between bank

loans. Loan levels are restricted to those combinations such that $1 - q_i - \gamma q_j > 0$ to ensure a non-negative price. This functional form[16] satisfies the restrictions from section 2:

$$\begin{aligned} R^i_{ii} &= -2(z_i + e^{-z_i}) < 0, \\ R^i_j &= -z_i \gamma q_i < 0, \\ R^i_{ij} &= -z_i \gamma < 0, \\ R^i_z &> 0, \; R^i_{iz} > 0. \end{aligned}$$

4.1 Equilibrium values

In this numerical example, debt levels are strategic substitutes. In accordance with Proposition 2, blockholders always issue more debt than managers. In section 3, we show that a blockholder facing a competitor bank with a manager in control issues more debt than one facing another controlling blockholder. We find numerically that managers' debt choices do not differ greatly whether they are facing another manager or a blockholder.

Result 1 *In equilibrium,* $0 < D^{MM} \approx D^{MB} < D^{BB} < D^{BM}$.

Furthermore, equilibrium debt issue is lower the more substitutable are bank loans. On average, a manager's debt issue is most responsive to changes in γ, while the debt issue by a blockholder facing a manager is the least responsive.

Result 2 *In equilibrium,* $\dfrac{dD^{MM}}{d\gamma} \approx \dfrac{dD^{MB}}{d\gamma} < \dfrac{dD^{BB}}{d\gamma} < \dfrac{dD^{BM}}{d\gamma} < 0.$

We obtain this result from regressions with data generated from the numerical simulations. Managers' debt choices are sensitive to changes in the substitutability between bank loans because this directly impacts profitability, and managers care *only* about profits. Blockholders are concerned with mitigating the agency problem between managers and shareholders as well as with profitability. This second concern reduces the blockholder's sensitivity towards changes in γ. Figure 3 plots equilibrium debt levels against γ; D^{MM} and D^{MB} do not coincide exactly, due to random deviations arising from the numerical solution procedure. We find the difference between the two values to be statistically insignificant.[17]

Figure 4, which plots equilibrium industry output against γ, demonstrates Proposition 3. Our numerical examples lead us to the following conclusion regarding the relationship between ownership regime and firm value. Denote the value of a B-controlled bank facing a B-controlled bank as V^{BB}, the value of a B-controlled bank facing an M-controlled bank as V^{BM}, the value of an M-controlled bank facing a B-controlled bank as V^{MB}, and the value of an M-controlled bank facing an M-controlled bank as V^{MM}.

Result 3 *In equilibrium,* $V^{MB} < V^{MM} < V^{BB} < V^{BM}$.

[16] Given this specification, one interpretation of z is as a shock common both to bank revenues and to bank costs, such as an exchange rate shock or a macroeconomic shock. Since the shock affects revenues linearly and costs non-linearly, revenues and costs are imperfectly correlated.

[17] Our statistical inference assumes that the deviations due to the numerical procedure are normally distributed around a mean of zero.

The result is demonstrated in Figure 5, which plots equilibrium firm values against γ. The value under a controlling blockholder is always higher due to the benefits of control; that is, the blockholder mitigates agency problems, and this is value-increasing. The blockholder who faces a manager-controlled bank benefits even more from the fact that the manager issues less debt, enabling the blockholder-controlled bank to gain market share. Likewise, the manager who faces a blockholder-controlled bank loses market share, and thus firm value is lower than it would be if the rival firm were manager-controlled.

4.2 Policy implications

Our analysis demonstrates that legal restrictions on the concentration of ownership can affect bank value and competition in the loans market. Marginally relaxing this restriction will have an effect only in cases where the restriction has not prevented blockholding and monitoring to occur in the first place (case I). If ownership restrictions are binding, so that they either prevent blockholding or they prevent monitoring even in the presence of blockholdings, then a marginal increase in the maximum shareholding will generally not have any effect on bank value or competition in the loans market. For a relaxation of bank shareholding restrictions to be beneficial, the increase in maximum shareholding may need to be substantial.

Our model abstracts from other conflicts of interest between equity holders and debt holders (risk-shifting) and between blockholders and minority shareholders (self-dealing). While the problem of risk-shifting is particularly relevant to highly leveraged institutions such as banks, capital requirements and positive franchise values mitigate the problem. Moreover, this problem is associated with leverage and not concentration ownership per se.

Although the original economic justification for bank shareholding restrictions was to prevent self-dealing, these regulations are a relatively old phenomenon, dating back to the 1960s in some countries. Since that time, two important developments bear mention. First, in the 1980s and 1990s, there was a revolution in corporate governance in the banking sector, as well as more generally. This revolution included changes such as an increased emphasis on outside directors, new rules for electing boards, and more internal oversight. Second, in the post-Basel era, there is increased supervision of banks, particularly large, multinational banks. Taken together, these phenomena vastly reduce the scope for self-dealing by blockholders. The justification for these restrictions, while fairly universal in the 1960s, largely does not exist in most industrialized countries today.

The likelihood that a given restriction on ownership concentration will be binding depends on the functional form for $p(\alpha)$ and on the values of model parameters, such as c, γ, and ϕ. As noted in the appendix, we use three functional forms for $p(\alpha)$, which we denote as p_1, p_2, and p_3.[18] Each function has a behavioural interpretation. The function p_1 represents the idea that only a sole proprietor has total control over the bank; even a majority shareholder may face legal opposition from determined minority shareholders. Both p_2 and p_3 have the property that $p(1) < 1$; a sole proprietor may not obtain full control if there are legislative restrictions or other barriers. Moving from p_1 to p_3, effective control decreases for a given level of α. That is, $p_1(\alpha) < p_2(\alpha) < p_3(\alpha)$.

Focusing on the situation where $V^{BB} + V^{MM} - V^{BM} - V^{MB} < 0$ (ignoring case IIb, which rarely occurs), no blockholding occurs (case III) whenever $\alpha^{max} \in [0, \overline{\alpha}(0)]$. Blockholders are present, but no monitoring takes place (case IIb), whenever $\alpha^{max} \in [\overline{\alpha}(0), \overline{\alpha}(\alpha^{max})]$. Both critical values, $\overline{\alpha}(0)$ and $\overline{\alpha}(\alpha^{max})$, depend positively on cost of monitoring, c, and the level of diversion,

[18] p_1 is linear in α; p_2 is concave for all α; and p_3 is convex for α smaller than some value, and concave for α larger than that value.

Table 1: Summary of Numerical Examples

$p(\alpha) = p_1(\alpha)$	$\phi = 0.05$	95% are binding at $\alpha^{max} = 10\%$ 77% are binding at $\alpha^{max} = 20\%$
	$\phi = 0.20$	97.5% are binding at $\alpha^{max} = 10\%$ 83% are binding at $\alpha^{max} = 20\%$
$p(\alpha) = p_2(\alpha)$	$\phi = 0.05$	95% are binding at $\alpha^{max} = 10\%$ 80% are binding at $\alpha^{max} = 20\%$
	$\phi = 0.20$	96.5% are binding at $\alpha^{max} = 10\%$ 84% are binding at $\alpha^{max} = 20\%$
$p(\alpha) = p_3(\alpha)$	$\phi = 0.05$	100% are binding at $\alpha^{max} = 10\%$ 100% are binding at $\alpha^{max} = 20\%$
	$\phi = 0.20$	100% are binding at $\alpha^{max} = 10\%$ 100% are binding at $\alpha^{max} = 20\%$

ϕ (the latter to a much smaller extent), and depend negatively on the substitutability of bank loans, γ. Hence, a shareholding restriction is more likely to prevent blockholding or monitoring the higher the monitoring and agency costs, and the lower the substitutability of bank loans. Table 1 summarizes the results from our numerical examples. Since the median (and modal) restriction among countries that use restrictions in the World Bank database is $\alpha_{\max} = 0.2$, we focus on this as a benchmark. Over all three functional forms for $p(\alpha)$, the widely held rule almost always (close to 90 per cent of the time) deters monitoring, unless monitoring costs are minimal. The interpretation of these figures is complicated, since we do not calibrate our model for any particular economy. Our results indicate that a typical shareholding restriction, such as $\alpha_{\max} = 0.2$, is likely to prevent monitoring and cause a non-competitive outcome in the loans market equilibrium.

Consider the moderately restrictive scenario (case IIb), which is the equilibrium outcome whenever the restriction α^{max} falls in the range $[\overline{\alpha}(0), \overline{\alpha}(\alpha^{max})]$. The likelihood of case IIb is correlated with the size of the gap, $\overline{\alpha}(\alpha^{max}) - \overline{\alpha}(0)$. In our numerical examples, the range of values obtained for the gap is $[0, 0.043]$. The monitoring cost, c, has a positive effect on the size of this gap (and the largest effect relative to other parameters), γ has a significantly negative but small effect, and ϕ has little or no effect.

Case IIb is particularly interesting because the shareholding restriction does not prevent the existence of blockholders, but these blockholders exist only to prevent the other blockholder from monitoring. No monitoring occurs in these situations. That is, society does not derive any benefits from ownership concentration. Hence, if there are (unmodelled) costs to ownership concentration, case IIb is associated with lower social welfare relative to case III, in which no blockholders exist. A relaxation of shareholding restrictions that induces a shift from case III to case IIa results in a net decrease in social welfare. However, a complete abolition of shareholding restrictions, or an increase in maximum allowable shareholding that is sizable enough to ensure we obtain case I, can be socially beneficial.[19]

[19] This causes an increase in industry output (from Q^{MM} to Q^{BB}) and an increase in bank value (from V^{MM} to V^{BB}).

5. Some Empirical Facts

Our model is theoretical; we derive analytical results for some parts of the model and use numerical solution techniques to explore other parts of the model. This section does not estimate the theoretical model or add credence to the numerical portion of the model, since we do not calibrate it to any country's banking system. Rather, this section takes two results which emerge from the model and shows that some data generally support these results. We examine the effect of blockholding on the leverage ratio and on bank profits.

5.1 Blockholders and the leverage ratio

The leverage ratio is the value of debt divided by the value of debt plus equity. It is well known that banks have high leverage ratios in general (Phillips 1964, 44). In our numerical simulations, we find that blockholder-controlled banks have higher leverage ratios than manager-controlled banks. We construct a sample of 48 publicly traded banks for which we could collect data on both ownership and leverage,[20] where ownership is defined as the percentage of shares held by the single largest shareholder and leverage is defined as debt divided by equity plus debt. These banks come from Australia, Hong Kong, India, Singapore, and Taiwan[21] (each of these countries, except for Hong Kong, has ownership restrictions). We regress leverage on ownership, including country dummies for all countries except Australia. We posit that blockholders choose higher leverage ratios. Assuming that it is not the case that potential blockholders prefer to buy more highly leveraged banks, so that reverse causation is a problem, ordinary least squares provides a consistent estimate of this relationship.[22] Table 2 shows our results. In summary, we find that ownership structure and leverage ratios are positively related for our sample of banks and that this effect is significant at the one per cent level (two-sided test).

Table 2: Regression Results: Ownership and Leverage

	Const.	Hong Kong	India	Singapore	Taiwan	Ownership
Coefficient	9.3E-1	-5.6E-2	-9.8E-3	7.4E-2	1.4E-2	3.7E-4
T-statistic	166.86	-4.53	-1.08	-5.51	-2.04	2.65
R^2	0.57	Number of banks		48		
R_a^2	0.52	Degrees of freedom		42	Critical t-value	2.02

The average (Australian) bank has a leverage ratio of 93 per cent. Banks in the other countries have somewhat lower ratios. If a blockholder were to acquire a 50 per cent share in a bank without a previous blockholder, that bank's leverage would rise by 1.5 percentage points, other things equal.[23] How close are our numerical results to the ones we find in the data? We compute the leverage ratio for 88 sets of parameter values in the model: 44 with a controlling blockholder and 44 without. The average leverage ratio for banks with a controlling blockholder is about 5 percentage

[20] A list of the banks is given in the appendix.

[21] The data for Australia are hand-collected from annual reports. The data for the other countries are taken from Bankscope.

[22] This assumption is consistent with the work of Chaplinsky and Niehaus (1993), who show that leverage and (inside) ownership do not have common determinants.

[23] In a case study, Denis and Sarin (1999) show that changes in blockholdings are followed by asset sales. If debts remain fixed, decreased assets imply an increased leverage ratio.

points higher than for the bank without one. The overall average leverage ratio is 85 per cent, not much lower than it is in the data. These results can be viewed as a broad confirmation of our choice of the function R.

5.2 Blockholders and profits

In the model, higher debt leads to more loans, and blockholders issue more debt. Therefore, blockholder-controlled banks extend more loans, moving from the pure Cournot outcome with positive profits towards the competitive outcome with zero profits. That blockholder-controlled banks make smaller profits is a testable implication. We use the data from the Australian banks only.[24] Table 3 shows the correlations between measures of performance and profits. We use correlations because the sample size of 11 does not permit good inference from regression analysis.

Table 3: Correlations Between Blockholders and Performance

Variable	Variable	Correlation
Largest block	Profit/Assets	-0.28**
Largest 20 blocks	Profit/Assets	-0.19
Largest block	Total equity	-0.07
Largest block	Total assets	-0.05
Number of banks		11

Notes: Significance levels of 10 per cent and 5 per cent are denoted by one and two asterisks, respectively. Significance tests are based on the Fisher transform of the correlation coefficient and the null hypothesis that the correlation between any two variables is zero. The "Largest block" is the percentage of shares held by the single largest shareholder (individual or firm). The "Largest 20 blocks" is the sum of the shareholdings of the largest 20 shareholders.

Note that block size is essentially uncorrelated with bank size, as measured by equity or by assets. Profits and blockholdings are negatively correlated, although that correlation is not significant when looking at the largest 20 blockholders together. This fact is consistent with our debt-issuance story. In our model, we also find a positive relationship between blockholding and bank value, similar to that found by Barclay and Holderness (1990) and Caprio, Laeven, and Levine (2004) in two empirical studies. Given the small size of our sample, we do not attempt to replicate their result. We refer readers to their papers for corroborative evidence of the positive relationship between blockholders and bank value.

6. Conclusion

This paper examines whether a restriction on ownership concentration affects competition in the bank loan market. Our analysis demonstrates that legal restrictions on the concentration of ownership can affect bank value and competition in the loans market. Marginally relaxing this restriction will have an impact only in cases where the restriction has not prevented blockholding and monitoring from occurring in the first place. If ownership restrictions are severe enough to prevent blockholding or monitoring (even if blockholders exist), then a marginal increase in the maximum

[24] The profit data for the other countries are not reported in our database. Profit data for Australia are taken from the annual reports of the various banks.

shareholding will generally not have any impact on bank value or competition in the loans market. For a relaxation of bank shareholding restrictions to be beneficial, the increase in maximum shareholding may need to be substantial.

Ownership concentration matters in our model because it provides the incentives to the blockholder to engage in costly monitoring, a necessary step to obtaining the right to set the level of unsecured debt. We show that blockholders always issue more debt than managers. Debt is socially beneficial in two ways: it alleviates the agency problem and it is pro-competitive, because a higher level of debt induces the manager to compete more aggressively in the loans market. Hence, increased ownership concentration with monitoring creates a more competitive banking industry. We do not, however, model a cost to ownership concentration. In particular, we assume that there is no conflict of interest between blockholders and atomistic shareholders. We also do not model a mechanism by which control by the blockholder may adversely affect managerial incentives. A more balanced analysis might introduce a trade-off to ownership concentration or to debt issue. Hence, we might extend our analysis in two ways. In one approach, we can introduce some self-dealing by blockholders. In the other, we can model debt as impairing managerial incentives to exert effort that may raise firm profitability. Further research on these issues may prove fruitful.

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Figure 1: Bank Shareholding Restrictions

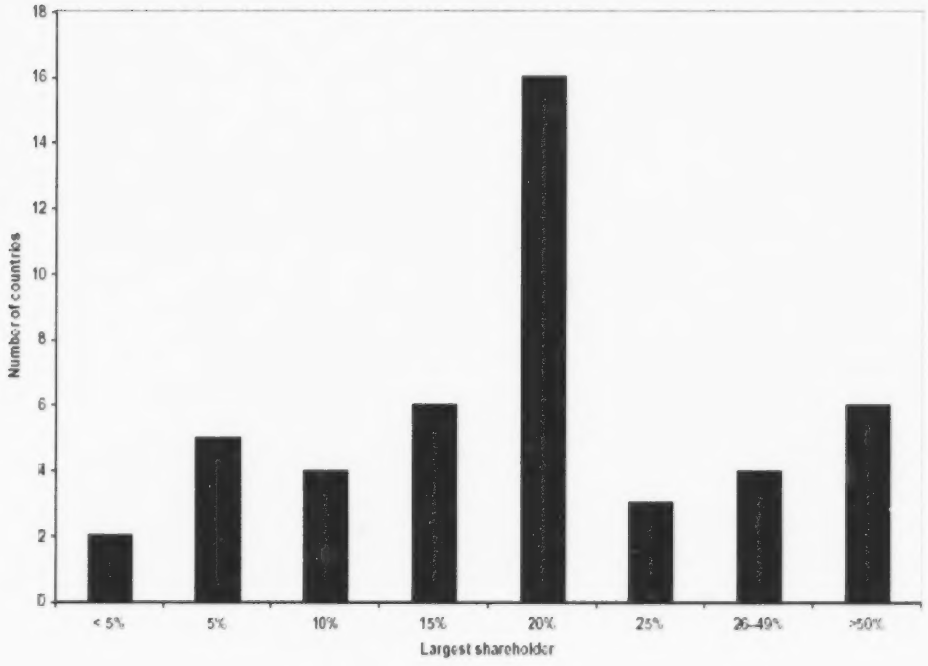


Figure 2: Timeline of the Model

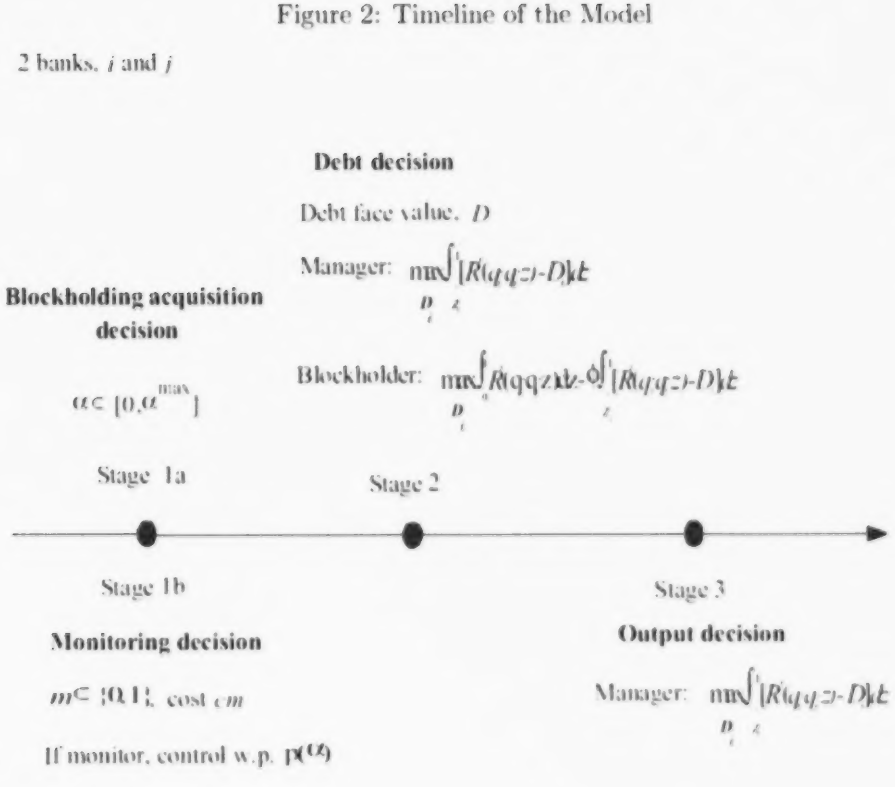

2 banks, i and j
Debt decision
Debt face value, D
Manager: $\max_{D_i} \int_z^1 [R(q_i q_j z) - D] dz$
Blockholding acquisition decision
$\alpha \in [0, \alpha^{max}]$
Blockholder: $\max_{D_i} \int_0^{\alpha} R(q_i q_j z) dz - \alpha \int_z^1 [R(q_i q_j z) - D] dz$
Stage 1a
Stage 2
Stage 1b
Stage 3
Monitoring decision
$m \in \{0,1\}$, cost cm
If monitor, control w.p. $p(\alpha)$
Output decision
Manager: $\max_{D_i} \int_z^1 [R(q_i q_j z) - D] dz$

Figure 3: Debt Level, $\phi = 0.2$

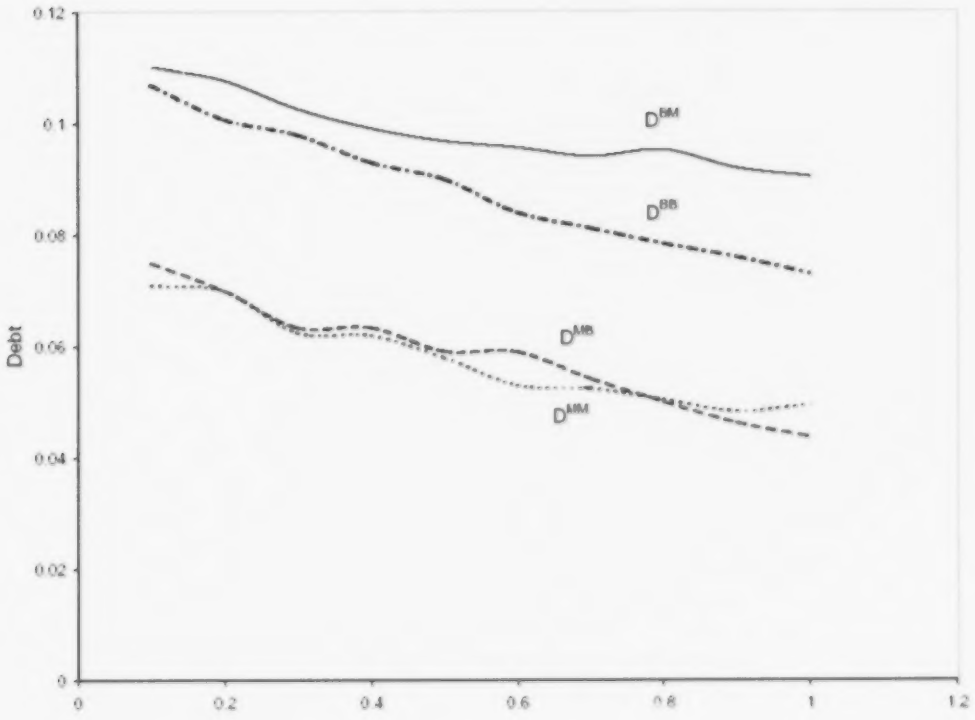


Figure 4: Industry Output, $\phi = 0.2$

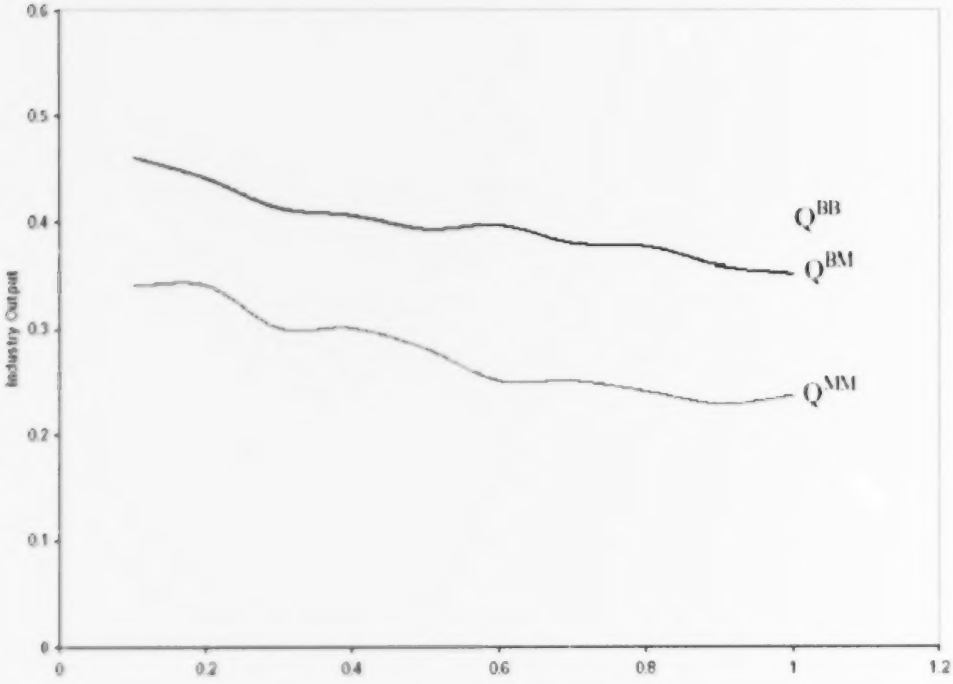
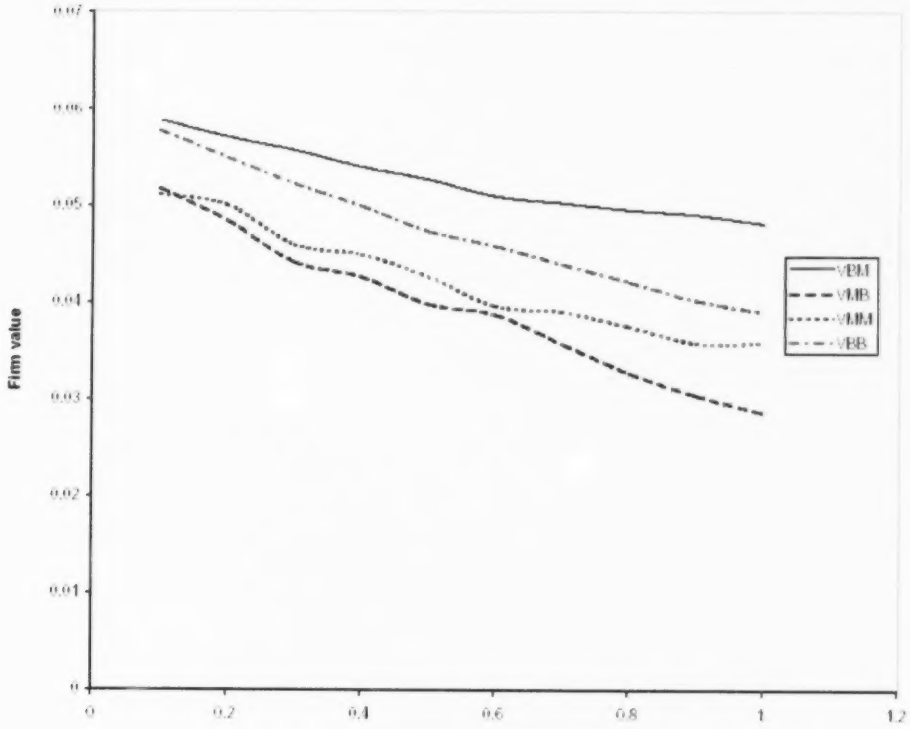


Figure 5: Firm Value, $\phi = 0.2$



Appendix

A.1 Bank Shareholding Restrictions, By Country

Tables A1 to A3 show the countries with formal restrictions on bank shareholdings as of 2003. The information is compiled from the World Bank Survey of Bank Regulation and Supervision (2003 version).

Table A1: Bank Shareholding Restrictions (High-Income Countries)

Country	No. of banks, Dec 2001	Share limits: People (%)	Share limits: Firms (%)	Exceed?
Aruba	5	5	5	CB
Australia	52	15	15	TR
Br. Virgin Is.	5	a	a	No
Canada[25]	64	20	20	No
Cyprus	12	50	50	No
Luxembourg	189	a	a	No
Norway	15	10	10	No
Qatar	15	10	10	No
Singapore	128	5	5	CB
Slovenia	21	20	20	CB
Taiwan	44	5	5	No
Turks and Caicos	8	49	49	No

Notes:
a – must have at least two shareholders
CB – Central bank
Exceed – the organization that may permit exceeding the limits
"No" if none exists
TR – Treasury

[25] The restriction to 20 per cent ownership in Canada applies only to banks whose capital is five billion Canadian dollars or greater.

Table A2: Bank Shareholding Restrictions
(Middle-Income Countries)

Country	No. of banks, Dec 2001	Share limits: People (%)	Share limits: Firms (%)	Exceed?
Columbia	29	95	95	No
Costa Rica	21	a	a	No
China*	105	10	10	No
Egypt	53	10	10	CB
Guyana	7	20	20	No
Malaysia	25	10	20	No
Malta	15	5	5	CB
Mauritius	10	15	15	No
Mexico	32	20	20	No
Montserrat	2	20	20	MF/CB
Nicaragua	6	20	20	No
Oman	15	15	25-35	No
Philippines	42	40	40	Pres.
Puerto Rico	17	5	5	Comm.
Sri Lanka	25	10	10	CB
St. Kitt's/Nevis	6	20	20	No
St. Lucia	7	20	20	MF/CB
St. Vincent	5	20	20	MF/CB
Thailand	31	5	5	No
Turkmenistan	13	35	35	No
Ukraine	152	a	a	No
W. Samoa	3	20	20	No

Notes:

a – must have at least two shareholders

CB – central bank

Comm. – commission

Exceed – the organization that may permit exceeding the limits

"No" if none exists

* – denotes country covered in 2001 Survey but not in 2003 Survey, information dates prior to Dec 2001.

MF – Ministry of Finance

Pres – President

Table A3: Bank Shareholding Restrictions (Low-Income Countries)

Country	No. of banks, Dec 2001	Share limits: People (%)	Share limits: Firms (%)	Exceed?
Bangladesh*	50	10	10	No
Bhutan	2	20	20	No
Burundi	7	20	20	No
Fiji	6	15	15	No
Gambia	6	10	10	No
Georgia*	29	25	25	No
Grenada	5	20	20	MF
India	97	60	60	No
Kenya	46	25	25	No
Kyrgyzstan	20	15	15	No
Nepal*	13	49	49	No
Serbia/Montenegro	49	a	a	No
Sudan	25	10	10	No
Swaziland	4	25	25	No
Turkmenistan	13	35	35	No
Vietnam*	48	5	5	No
Zambia*	16	25	25	No
Zimbabwe	24	10	25	No

Notes:

a – must have at least two shareholders

Exceed – the organization that may permit exceeding the limits

"No" if none exists

* – denotes country covered in 2001 Survey but not in 2003 Survey, information dates prior to Dec 2001.

MF – Ministry of Finance

A.2 List of Banks Used in Section 5

Australia

Adelaide Bank
ANZ Bank
Bank of Queensland
Bank of Western Australia
Bendigo Bank
Commonwealth Bank of Australia
Macquarie Bank
National Australia Bank
Rock Building Society
St. George's Bank
Westpac Bank

Hong Kong

Bank of East Asia
Hang Seng Bank
Liu Chong Hing Bank

India

Andhra Bank
Bank of India
Bank of Punjab
Bank of Rajasthan
Corporation Bank
Dena Bank
HDFC Bank
ICICI Bank
IDBI Bank
Jammu and Kashmir Bank
Kamataka Bank
Oriental Bank of Commerce
SREI International Finance
State Bank of Bikaner and Jaipur
State Bank of India
State Bank of Mysore
Syndicate Bank
Uti Bank

Singapore

Overseas Chinese Banking Corporation
United Overseas Bank

Taiwan

Bank of Overseas Chinese
Bank SinoPac
Chang Hwa Commercial Bank
Chiao Tung Bank
Chinese Bank
Cosmos Bank
E. Sun Commercial Bank
Grand Commercial Bank
Macoto Bank
Pan Asia Bank
Taichung Commercial Bank
Union Bank of Taiwan
United World Chinese Commercial Bank

A.3 Proofs of Lemma and Propositions

Proof of Proposition 2.

We denote a bank's debt capacity as $\overline{D}_i = \arg\max_{D_i} V^{iD}(D_i, D_j)$, where V^{iD} is the value of debt for bank i, given Cournot equilibrium quantities, as functions of debt levels. That is,

$$V^{iD} = \int_0^{\hat{z}_i} R^i(q_i^*, q_j^*)dz + (1 - \hat{z}_i)D_i.$$

Furthermore, note the following relationship between firm value (V^{IB}), debt value (V^{ID}), and equity value ($(1-\phi)V^{IM}$, where V^{IM} is the manager's objective function):

$$V^{iB} = V^{iD} + (1 - \phi)V^{iM}.$$

To assume that the bank remains within its debt capacity at all optimal debt levels (for the blockholder and for the manager) is equivalent to assuming that we obtain interior solutions for both the blockholder's and the manager's problems. This imples that

$$\left.\frac{\partial V^{iB}}{\partial D_i}\right|_{D_i^M(D_j)} = \left.\frac{\partial V^{iD}}{\partial D_i}\right|_{D_i^M(D_j)} \geq 0,$$

and

$$\left.\frac{\partial V^{iM}}{\partial D_i}\right|_{D_i^B(D_j)} = -\left.\frac{\partial V^{iD}}{\partial D_i}\right|_{D_i^B(D_j)} \leq 0,$$

where $D_i^M(D_j)$ is the manager's debt reaction function and $D_i^B(D_j)$ is the blockholder's debt reaction function. Hence,

$$D_i^M(D_j) \leq D_i^B(D_j). \tag{11}$$

If debt levels are strategic substitutes and Nash solutions are stable, then

$$-1 < \frac{\partial D_i^M(D_j)}{\partial D_j} < 0, \tag{12}$$

$$-1 < \frac{\partial D_i^B(D_j)}{\partial D_j} < 0. \tag{13}$$

Inequalities (11) – (13) yield $D^{MB} \leq D^{MM} \leq D^{BM}$ and $D^{MB} \leq D^{BB} \leq D^{BM}$. Using the symmetric Nash equilibrium conditions, $D_i^M = D_j^M$ and $D_i^B = D_j^B$, with inequality (11) yields $D^{MM} \leq D^{BB}$. This completes the proof.

Proof of Lemma 1. Given that monitoring takes place, the bank's expected value is $p(\alpha_i)p(\alpha_j)V^{BB} + [1 - p(\alpha_i)][1 - p(\alpha_j)]V^{MM} + p(\alpha_i)[1 - p(\alpha_j)]V^{BM} + [1 - p(\alpha_i)]p(\alpha_j)V^{MB}$. The derivative of this with respect to α_i is positive. The derivative of the left side of (8) with respect to α_j is $\alpha_i p(\alpha_i)p'(\alpha_j)(V^{BB} + V^{MM} - V^{MB} - V^{BM})$. If $V^{BB} + V^{MM} - V^{MB} - V^{BM} < 0$, the left side of (8) decreases with α_j, implying that a larger α_i is required to induce monitoring; that is, $\overline{\alpha}'(\alpha_j) > 0$.

Proof of Proposition 4. In the highly restrictive situation (case III), no blockholder can be given the incentives to monitor, even by the largest block possible. Hence, the unique Nash equilibrium is (**NB**, **NB**), with both banks being widely held and industry output at Q^{MM}, the lowest level of all the cases we consider.

In the non-restrictive situation (case I), the unique Nash equilibrium is (**B**, **B**), where each bank has a blockholder who has a share, α^{max}, of the bank and monitors. Industry output is a function of who (blockholder or manager) wins control. Expected industry output is $[p(\alpha^{max})]^2 Q^{BB} + 2p(\alpha^{max})[1 - p(\alpha^{max})]Q^{BM} + [1 - p(\alpha^{max})]^2 Q^{MM}$. The derivative of this with respect to α^{max} is positive for all $p(\alpha^{max}) \leq 1$ and $p'(\alpha^{max}) > 0$. Hence, an increase in the legally allowable ownership concentration increases competition and industry output.

In the moderately restrictive situation (case II), we first consider the case of $V^{BB} + V^{MM} - V^{BM} - V^{MB} < 0$, since this is the more common case (for all but one) in our numerical simulations. In this case, a blockholder of size α^{max} will not monitor if faced by another blockholder of the same size. That blockholder will monitor, however, whenever the other bank is widely held. Thus, the outcome (**B, B**) involves blockholders in both banks who hold α^{max} of their banks but do not monitor because this shareholding does not provide the critical ownership level to induce monitoring, $\alpha^{max} < \overline{\alpha}(\alpha^{max})$. The bank's value is therefore the same as for widely held banks: $\mathcal{V}(\alpha^{max}, \alpha^{max}) = \mathcal{V}(0, 0) = V^{MM}$. If one bank, i, is widely held but the other bank has a blockholder of size α^{max}, that blockholder will monitor, since $\alpha^{max} < \overline{\alpha}(0)$. Hence, $\mathcal{V}(\alpha^{max}, 0) = p(\alpha^{max})V^{BM} + [1 - p(\alpha^{max})]V^{MM}$ and $\mathcal{V}(0, \alpha^{max}) = p(\alpha^{max})V^{MB} + [1 - p(\alpha^{max})]V^{MM}$. Therefore, if $\mathcal{V}(0, 0) - \mathcal{V}(0, \alpha^{max}) = p(\alpha^{max})(V^{MM} - V^{MB}) > 0$, the Nash equilibrium is (**B**, **B**). This is indeed the case (from Proposition 5): industry output is Q^{MM} and an increase in α^{max} has no effect on industry as long as $\alpha^{max} < \overline{\alpha}(\alpha^{max})$. An increase in α^{max} beyond $\overline{\alpha}(\alpha^{max})$ puts us into the non-restrictive case (I).

Suppose that $V^{BB} + V^{MM} - V^{BM} + V^{MB} > 0$. Then, a blockholder of size α^{max} will monitor if the other bank has a blockholder of the same size, but will not monitor if the other bank is widely held. Hence, $\mathcal{V}(\alpha^{max}, \alpha^{max}) = [p(\alpha^{max})]^2 V^{BB} + p(\alpha^{max})[1 - p(\alpha^{max})](V^{BM} + V^{MB}) + [1 - p(\alpha^{max})]^2 V^{MM}$, while $\mathcal{V}(0, 0) = \mathcal{V}(\alpha^{max}, 0) = \mathcal{V}(0, \alpha^{max}) = V^{MM}$. Since $\mathcal{V}(\alpha^{max}, \alpha^{max}) -$

$\mathcal{V}(0,0) > 0$ for all $p(\alpha^{max}) < 1$, the Nash equilibrium is **(B, B)**, in which both banks have blockholders who monitor. Expected industry output is the same as in the non-restrictive situation (case I).

A.4 Algorithm to solve for the Nash equilibria of stages 2 and 3 of the game

The solution is computed for fixed values of ϕ and γ. The solutions of type BB, MM, and BM/MB are each computed separately, in order to take advantage of the symmetries in the first two cases. The first step is to specify a parameter space for the quantities of loans, q_i and q_j. Since quantities cannot be negative, we use the closed interval [0,10] and partition it into 4,000 points. For each point $(q_i, q_j) \in [0,10] \times [0,10]$, we compute the following quantity: $z_s = \min_{z \in [0,1]} \left| z\left(\alpha - q_i - \gamma q_j\right) q_i - e^{-z} q_i^2 \right|$. Let $\hat{z}_s = \left| z_s\left(\alpha - q_i - \gamma q_j\right) q_i - e^{-z_s} q_i^2 \right|$. We define the space $\mathbf{Q} = \left\{ (q_i, q_j) \in [0,10]^2 \,|z_s < 0.99 \text{ and } \hat{z}_s > 0.01 \right\}$. This process of trimming the endpoints of the unit interval makes the solution more efficient. We specify a space for debt, DS, which is usually $[0, 0.15]$ in the first stage. Next we fix a debt level, $D_i \in DS$, and compute $\hat{z}_i$ for each (q_i, q_j) pair. For each q_j, we find q_i^*, which maximizes the objective function $\int_{\hat{z}_i}^{1} [R - D]\, dz_i$. The value q_i^* depends on D_i and q_j. We repeat this process for all q_j in $[0, 10]$, and then restart the process for another D_i searching over a large space for debts issued. We eliminate those triples (q_i, q_j, D_i) that fail to satisfy the second-order conditions of the output-stage maximization problem.

We then examine pairs $(D_i, D_j) \in DS^2$. For each pair, we look at the Nash quantities $q_i^*(q_j, D_i)$ and search for matched pairs. For example, suppose we are looking for the Nash equilibrium in quantities associated with debt levels $(0.05, 0.03)$. We look at the sets of Nash quantities from $D_i = 0.05$, calling them $\left(q_i^*(i), q_j^*(i)\right)$. We label the sets of Nash quantities from $D_j = 0.03$ as $\left(q_i^*(j), q_j^*(j)\right)$. We select pairs $\left\{ \left(q_i^*(i), q_j^*(i)\right), \left(q_i^*(j), q_j^*(j)\right) \right\}$, where $q_j^*(i) = q_i^*(j)$, and look for ones where $q_i^*(i) = q_j^*(j)$. Any pair such that $q_i^*(i) = q_j^*(j)$ is a Nash equilibrium in quantities. This may seem an unusual computational approach to determine a Nash equilibrium, but it relies on the fact that both banks have the same objective function (with the variables q_i and q_j switched). We then have, for all $(D_i, D_j) \in DS^2$, $q_i^*(D_i, D_j)$ and $q_j^*(D_i, D_j)$. The next step is to compute the Nash equilibrium debt strategy. The computational approach depends on whether the solution is for case BB, MM, or BM/MB. Since the BB and MM cases rely on symmetries, we focus on the asymmetric equilibrium for debt choice. We compute the values of the managers' objective functions and the blockholders' objective functions for banks i and j. For each level of debt, D_j, we determine the best response, $D_i^*(i, D_j)$, based on the objective function of bank i. We repeat the process and compute $D_j^*(j, D_i)$ using the other objective function. The two reaction functions may have a solution, which is a Nash equilibrium. It is likely that there be no solution in the first iteration. Since it takes such a long time to compute optimal quantities given debt levels, we do not search over many debt levels at a time. In the event that no solution appears, we fit linear regressions to the reaction functions, solve for the intersection, and continue our search for the optimal debt level in the neighbourhood of that intersection. Even if we do find a solution to the two reaction functions, the solution is imprecise. We typically "zoom in" on the part of the space DS^2 in which the "equilibrium" appears, in order to gain more precision.

A.5 Algorithm to solve for the Nash equilibria of stage 1 of the game

The first step is to partition the Nash equilibria of the debt stage into two sets. Let $F = V^{BB} + V^{MM} - V^{MB} - V^{BM}$, where V is the value of the firm. We determine the boundaries of the three cases for $F > 0$ and $F < 0$ separately. We need to specify a parameter space for c, the cost of monitoring. Based on the values of the firm computed above, we use $[0.0001, 0.0020]$, partitioned into 20 subintervals. We consider three functions for $p(\alpha)$:

$$p_1(\alpha) = \alpha,\ p_2(\alpha) = \ln(1+\alpha),\ \text{and } p_3 = \begin{cases} 0.996\alpha^2,\ 0 \leq \alpha \leq 0.3932 \\ \ln(\alpha + 0.774),\ 0.3932 \leq \alpha \leq 1 \end{cases}.$$

Each of these three functions has a behavioural interpretation. p_1 represents the idea that only sole proprietors can do what they want with their firms; even a majority shareholder may face legal opposition from determined minority shareholders. Both p_2 and p_3 have the property that $p(1) < 1$; a sole proprietor may not obtain full control if there are legislative restrictions or other random barriers. But the critical difference between p_2 and p_3 is that p_2 is globally concave, whereas p_3 is convex on the subset [0,0.3932] and concave on the subset [0.3932,1]. The convex-concave function captures the idea that, if a blockholder has a small block of shares, it may be almost infeasible to win control, but there is a threshold after which control becomes likely. Note that p_3 is a continuous function on [0,1], although not continuously differentiable. For each function, each cost, and each (ϕ, γ) pair, there is a partition of α-space that defines the boundaries of the three cases. We compute $\bar{\alpha}(0)$ and $\bar{\alpha}(\alpha)$ for all $\alpha \in [0,1]$ partitioned into 1,000 subintervals. From these calculations, the boundaries are apparent.

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